

DOCTOR OF PHILOSOPHY

EXPERIMENTAL IMPLEMENTATION OF A SINGLE ELEMENT TIME REVERSED ACOUSTIC PULSE (TRAP) SONAR

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The acoustic propagation complexity and variability of the littoral regions provide an increasingly challenging environment in which to conduct submarine sonar detection. Recent research with Time Reversal Acoustics (TRA) has demonstrated the ability of this approach to adapt in real time to these complex environments with little knowledge of the environmental parameters. Experimental active sonar research at the Naval Postgraduate School's Advanced Acoustic Research Laboratory (AARL) uses a laboratory scale, single element, shallow water active sonar system to demonstrate the improvement of target echo signal to noise ratio (SNR) by adapting the sonar transmit pulse in real time to the existing environment. The approach, called Time Reversed Acoustic Pulse (TRAP) sonar, demonstrated a 3 to 7dB SNR gain over more traditional matched filtered active sonar techniques. The SNR gain was demonstrated to be robust even in high noise environments, providing a 5 dB SNR final detection statistic from cases where traditional matched filtered technique had negative SNRs. TRAP sonar system applications for a barrier concept and a variable range focusing technique are also presented.

KEYWORDS: Time Reverse Acoustics, Active Sonar, Signal-to-Noise Ratio, SNR, Waveguide